Assignment 11.1 p. 519 #9-13 odd, 26, 28d, 29, 33-39 odd

9) $\dfrac{585\text{ g } C_3H_7OH}{1\text{ L soln}} \left| \dfrac{1\text{ mol } C_3H_7OH}{60.094\text{ g } C_3H_7OH} \right. = \mathbf{9.73\ M\ C_3H_7OH}$

11) $\dfrac{70.0\text{ mL}}{1000\text{ mL}} \left| \dfrac{1\text{ L}}{1\text{ L}} \right| \dfrac{3.0\text{mol } Na_2CO_3}{1\text{ mol } Na_2CO_3} \left| \dfrac{2\text{ mol } Na^+}{1\text{ mol } Na_2CO_3} \right. = 0.42\text{ mol } Na^+$

$\dfrac{30.0\text{ mL}}{1000\text{ mL}} \left| \dfrac{1\text{ L}}{1\text{ L}} \right| \dfrac{1.0\text{mol } NaHCO_3}{1\text{ mol } NaHCO_3} \left| \dfrac{1\text{ mol } Na^+}{1\text{ mol } NaHCO_3} \right. = 0.030\text{ mol } Na^+$

$$\mathbf{[\,Na^+\,] = \frac{0.45\text{ mol } Na^+}{0.100\text{ L soln}} = 4.5M}$$

13) As temperature increases, gas particles will have more average kinetic energy. Thus more gas particles will have enough energy to break free of the intermolecular attractive forces with the solvent.

39) Water is a polar molecule capable of hydrogen bonds, so solutes that are polar are soluble, especially those capable of hydrogen bonding. The greater the polarity, the greater the solubility.

a. CH_3CH_2OH is more soluble because it is polar.

b. $CHCl_3$ is more soluble because it is polar.

c. CH_3CH_2OH is more soluble than $CH_3(CH_2)_{14}CH_2OH$ because it is much more polar.

26) Pick a mass of solution (1000g)

40.0% by mass of 1000g = 400. g of $C_2H_6O_2$

$$n_{C_2H_6O_2} = \frac{400\text{ g } C_2H_6O_2}{} \left| \frac{1\text{ mol } C_2H_6O_2}{62.068\text{ g } C_2H_6O_2} \right. = 6.444\text{ mol } C_2H_6O_2$$

$$n_{H_2O} = \frac{600\text{ g } H_2O}{} \left| \frac{1\text{ mol } H_2O}{18.016\text{ g } H_2O} \right. = 33.3\text{ mol } H_2O$$

$$\mathbf{\chi_{C_2H_6O_2} = \frac{6.444\text{ mol } C_2H_6O_2}{39.75\text{ mol soln}} = 0.162}$$

$$V_{H_2O} = \frac{1000\text{ g soln}}{} \left| \frac{1\text{ mL soln}}{1.05\text{ g soln}} \right| \frac{1\text{ L soln}}{1000\text{ mL soln}} = 0.9524\text{ L soln}$$

$$\mathbf{M_{C_2H_6O_2} = \frac{6.444\text{ mol } C_2H_6O_2}{0.9524\text{ L soln}} = 6.77\ M\ C_2H_6O_2}$$

28d) $\chi_{C_6H_{12}O_6} = \dfrac{1\text{ mol } C_6H_{12}O_6}{10\text{ mol soln}} = \dfrac{1\text{ mol } C_6H_{12}O_6}{1\text{ mol } C_6H_{12}O_6 + 9\text{ mol } H_2O}$

I would dissolve 1 mole of sugar (180.2 g) in 9 moles of water (162.1 ml)

29)

$$n_{C_5H_{12}} = \frac{25\ mL\ C_5H_{12} \mid 0.63\ g\ C_5H_{12} \mid 1\ mol\ C_5H_{12}}{1\ mL\ C_5H_{12} \mid 72.15\ g\ C_5H_{12}} = 0.218\ mol\ C_5H_{12}$$

$$n_{C_6H_{14}} = \frac{45\ mL\ C_6H_{14} \mid 0.66\ g\ C_6H_{14} \mid 1\ mol\ C_6H_{14}}{1\ mL\ C_6H_{14} \mid 86.17\ g\ C_6H_{14}} = 0.344\ mol\ C_6H_{14}$$

$$\chi_{C_2H_6O_2} = \frac{0.218\ mol\ C_5H_{12}}{0.562\ mol\ soln} = 0.39$$

$$M_{C_5H_{12}} = \frac{0.218\ mol\ C_2H_6O_2}{0.070\ L\ soln} = 3.1\ M\ C_5H_{12}$$

33) Lattice energy is for the process of forming an ionic compound from elements in the gas phase. We are doing the reverse.

$$NaI(s) \longrightarrow Na^+(g) + I^-(g) \qquad \Delta H = -(-686\ kJ)$$

$$Na^+(g) + I^-(g) \longrightarrow Na^+(aq) + I^-(aq) \qquad \Delta H = -694\ kJ$$

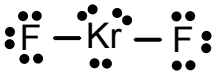
$$\mathbf{NaI(s) \longrightarrow Na^+(aq) + I^-(aq) \qquad \Delta H = -8\ kJ}$$

Since energy of hydration is greater than the lattice energy, NaI is soluble (solvation is thermodynamically favored.)

35) If $Al(OH)_3$ is insoluble, it's because it has a greater lattice energy than the energy of hydration, so solvation is thermodynamically unfavorable.

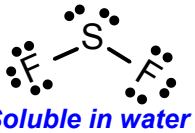
NaOH is very soluble because the energy of hydration is greater than the lattice energy (solvation is thermodynamically favored.)

37)a. KrF_2 = 22 v.e-



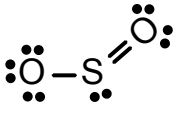
Soluble in CCl_4

b. SF_2 = 20 v.e-



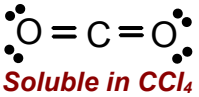
Soluble in water

c. SO_2 = 18 v.e-



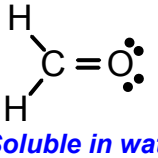
Soluble in water

d. CO_2 = 16 v.e-



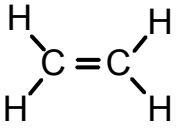
Soluble in CCl_4

f. CH_2O



Soluble in water

g. $CH_2{=}CH_2$



Soluble in CCl_4

e. MgF_2 is ionic

Soluble in water